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*To the Honorable the Mayor and Aldermen,
of the City of Charleston:*

GENTLEMEN—To hear both sides is the foundation principle which should govern those whose office it is to render decision upon any matter of importance, especially when it is to be an affair of public record.

As no opportunity has been afforded me to lay before your body the facts on which my action in reference to the Water Works is based, I deem it due to the importance of the subject, as well as to those who agree with me, and to my position in relation thereto, that I should make this communication.

No one would more gladly see the Water Works successfully established than myself, provided it is done without risk to the health of the City.

Several months ago it was brought to my attention that the pipes were being laid through the drains. As one of the Executive Committee of the State Board of Health, I deemed it my duty, in the absence of the Chairman, Dr. Geddings, to endeavor to effect a prevention of what I then thought, and still think, will produce damage to the public health.

On 18th October, 1879, I addressed a communication to the City Board of Health, and concluded by suggesting that "an inspection by a competent medical officer and sanitary engineer be made at once."

At a meeting thereupon held, the then City Registrar "read from his report prepared for the next meeting, calling attention to the very evil complained of by Doctors Simons and Fraser," and a resolution was passed referring it to the City Registrar and Committee on Hygiene, to report at the next meeting of the Board, and that in the meantime Mr. Nipson be instructed to stop the Company from going through lateral drains. (See The News and Courier, October 22, 1879.) I never heard of any report of the Com-

mittee, and learning that drains were still passed through, and seeing instances of it myself, I brought the subject to the attention of the present Mayor, and the recent discussion has been the result. The points raised were:

1st. That the drains were obstructed, and their usefulness impaired, which must be prejudicial to the public health.

2d. That the pipes pass through the drains in such a manner as to expose the water supply to contamination.

These questions were referred by the City Council to two Committees—the first to the Committee on Streets; the second to the Board of Health.

The first, which is the most important, at least for the present, has not been reported upon, and, so far as I can learn, no investigations have been made with this object in view, either by that Committee or any other persons appointed for that purpose. I believe the drainage has been seriously interfered with, and I do not think any investigation into the effects of such interference can be considered unless the work be carefully examined from end to end. Since my communication, the work has progressed in the same way without interruption by the City Government, notwithstanding such objections, each day adding to the expense and labor incident to a proper examination.

These objections are based upon facts which prove that the obstruction to the drains need not be complete to constitute serious interference with their usefulness. In Evansville, Indiana, such obstruction of drains by water pipes actually took place. A communication from Dr. J. W. Compton, of that City, well known as a sanitarian, is evidence of the fact. He says: "In one instance last summer where a pipe crossed a sewer two feet from its bottom, a piece of plank floating in the sewer lodged against the pipe, sewage lodged against this obstruction, and a deposit some two or more feet in depth settled in the sewer for some considerable distance above. The warm season was at hand, and rapid decomposition and putrefaction of this deposited sewage took place; foul, offensive and poisonous gases were evolved and escaping from the inlets, invaded houses near

by, and so polluted the atmosphere on the streets that it became an intolerable nuisance, and the people cried out against it until the authorities were compelled to send men into the sewer to examine the cause of all this disagreeable and dangerous exhalation, when the facts I have stated above were found to exist."

It is useless at this date to enter into a discussion as to the importance of drainage to the maintenance of the healthful condition of a city; this is admitted by all sanitarians and thinking men.

As to the fact that the drains have been pierced, encroached upon, and thus impaired in their efficiency, I think there can no longer be any doubt entertained. The City Civil Engineer has admitted it in his Report of January 8, 1880, and, in addition, I have the written statements of a number of citizens who have seen it; some complaining that their sight and smell were daily offended by the process, and I can testify to the perforation myself after actual examination.

It is not surprising that all citizens whose drains have been interfered with are not aware of it, for the people usually entrust these matters to the government, in the very reasonable expectation that their rights should be guarded, and their sanitary affairs protected without their personal supervision.

The agitation of this matter began with some of our most respected citizens. I would refer you to The News and Courier, where a letter will be found from Mr. Wm. Ravenel and Major L. D. DeSaussure to Mayor Sale, dated May 17, 1879, in which they remonstrate against the invasion of the rights of citizens by the Water Company in the destruction of and interference with the channels and level of drains on the Battery. This communication was referred to the Committee on Streets. No report has ever been made, so far as I can learn after diligent inquiry.

I have a letter from Major DeSaussure, February 26, 1880, in which he names the localities, and states his ability and willingness to point out the drains of which he complained,

to those persons authorized by the City Government to make an examination.

I have a written statement from another gentleman that he saw the water main pass through the sewer in Queen Street, at the corner of Mazyck Street, next to the Roper Hospital, near the floor level, and that the sewage poured out at each aperture in the sewer, giving off offensive odors.

In this connection I must allude to the statement made by the Committee on Hygiene, that the water pipes have passed through the drains in a "few" instances, "ascertained," "numbered," but they have not given the number or places. But do not be led into the mistake that this statement, if accurate and correct, represents the total number, for no record has been kept by the Health Office before 18th October, 1879, when my communication, already alluded to, was directed to them, and the condition of the drains interfered with was unknown to them, except from the statements of those engaged in the projection of the Water Works.

In an investigation of this kind I maintain that observations other than those made by competent sanitary officers are not to be considered.

It is useless to furnish further evidence of the destruction of drains and the impairment of their efficiency, for it seems to me the point is yielded, when, at this juncture, it is proposed by the Board of Health to place a new system of drains. Let us, for a moment, consider and reflect on the magnitude of the work contemplated. If it be carried out, both the objections raised will then be removed. But to any thinking mind it is evident that this cannot be accomplished for years. Consider, then, the condition of Charleston under the circumstances of this delay. Let those who lightly regard it read the account of the epidemic of yellow fever at Savannah in 1876, written by Dr. Woodhull, of the United States Army, and shudder.

Is the work to be done by the City? The answer is another question. Has it the money now? Look at our impassable streets, and the answer is plain. Is it to be done by the citizens, individually? This question is well worthy

of consideration, but it does not lie in the domain of the sanitarian to answer it. To get an idea of what it will cost to put a proper system of drains (no other should be tolerated), let me mention that I am informed that five hundred men are employed at the present time in Memphis for a similar purpose. Calculate the expense, and see how long we will be without drains. Destroy what you have for water, and then you leave no means for carrying off the filth that you desire to remove with it.

The second question—viz: that concerning the possible or probable contamination of the water by sewer gas and sewage is, in my opinion, inseparable from the first, but has been elevated beyond it and to its entire exclusion. This was referred to the Board of Health, and reported on by its Committee on Hygiene. Their report was presented to the Council at the last meeting.

It is necessary, to complete the history of this matter, that I should point out some errors of fact and reasoning in this report, and also to protest as to the manner in which the investigation by that Committee was conducted.

If the Committee on Hygiene made any examination at all, except as to the three drains in Mazyck Street, they have given no details. They have not examined at the points mentioned by Mr. Ravenel and Mr. DeSaussure, or anywhere else where the pipes were laid previous to 18th October, 1879. I had no opportunity to be present at the examinations made. On the day the Mazyck Street examination was to be had I left my office at 10 A. M. and returned at 2 P. M., and found a note left during the interval, stating that the examination would be made at 12 M.

Whilst their report was in progress, I called on the three medical members of the Committee to object. Two of these gentlemen I saw; on the third I called twice, but failed to obtain an interview. To one of them I gave a written protest, and to both indicated drains I desired examined. I regret I did not have the opportunity to point out the places I desired examined, which have not been touched by the Committee. This Committee admit some

delay in reply to the call made on them by Council. This loss of time reached nearly, or quite, four weeks. When it was first referred to the Committee they did not order the work stopped until an investigation was made, but it was allowed to proceed, and in this way the expense and labor necessary to a proper and systematic investigation to define what the influences may be to which the pipes may be subjected was greatly increased. The first point of the investigation should have been to find out the connection between the pipes and the drains. This has not been done, or at least not in the manner necessary for a collection of the facts on which to base a report. No detailed statement of personal investigation on the part of the Committee has been made. No one besides the Engineer and those engaged in placing the pipes has been heard, as far as I know, and no arguments that have been offered have been commented on or disproved.

There are few who would not exchange cisterns for pure Artesian water; but many prefer it, and object to water run through pipes traversing drains, for the reason that no instance of epidemics due to cistern water has been instanced by the Committee. Indeed, the Committee say that the befouling of cisterns is not invoked to account for the origin of yellow fever, typhoid fever, or other diseases. On the other hand, I have cited a case of an epidemic of typhoid fever directly traced to contamination of water obtained from a general supply. The contamination was directly traced to a water pipe passing through a sewer. The disease disappeared when the pipe was run over the sewer. No consideration has been given to this case by the Committee, although referred to number and page of The American Journal of the Medical Sciences, one of the best medical periodicals in the world. It is also well known to readers and students of sanitary medicine that epidemics of disease have been produced in England and elsewhere by milk diluted with water polluted by drainage. Even pans and pails washed in such water have produced like results. The observations of the Massachusetts Board of Health on

this subject, quoted in Cameron's Manual of Hygiene, are well known to all sanitarians. Such epidemics from the use of the cistern water, which is spoken of in such dreadful terms by the Committee, are not mentioned by them. In this connection, I call attention to the fact that the reservoir of the Water Works, situated in the middle of the City, twelve feet below the surface, is subject to the same contamination by percolation through the soil, as instanced by the Committee in reference to the cisterns, only in greater degree, because of the extent of surface exposed and the depth to which it is sunk. The reservoir, being uncovered, is also exposed to the same deposits mentioned as being washed from our sheds into our cisterns.

The report states that the flow of water is to be constant. I have already shown that the pressure by which this is to be attained must, in the nature of things, cease from time to time, and a casual reading of the rules and regulations of the Water Company will convince the unprejudiced that the Company themselves contemplate the necessity of stopping the flow, at least occasionally, for repairs.

I have a letter dated February 19, 1880, from William Drummond, Esq., Chairman of the Local Board of Health at Croydon, a suburb of London, England, in which he describes the manner in which water was contaminated in that town, when the water supply was intermittent. He says that air was drawn into the water pipes from water closets when the water supply was stopped. "Some illness was supposed to arise from the mode in which the water closets of the town communicated with the water-mains. * * * To avoid such doubt, our water supply has been made constant, and the connection between the water supply and the sewers has been so altered that there is no chance of the foul air and other foul matter being sucked back into the mains through the water closets." "Since this arrangement has been made our town has been remarkably healthy."

I am familiar with the theory on which the pipes are prepared, and which the Committee detail second-hand; but I have called attention to the fact that the coal-tar varnish

has not proved protective against rust, as may be seen by examination of pipes lying on the surface in this City. The Committee have not stated their observations on this point nor disproved this statement. By accident, I had the opportunity to examine the specimen joint and the iron of which the pipe exhibited to the Committee is composed, and did so in the presence of another person. Notwithstanding the care with which the edges of the longitudinal section have been filed and prepared, it is evident that there are many imperfections in the iron; indeed, it is honeycombed in some places. The Committee state, and quote authority for it, that pipe unprotected by any coating, either on its interior or exterior surfaces, may be used for one hundred years without diminution in weight or strength. An examination of gas pipe in this City is not in accord with this statement; and one of the members of the Board of Health has recently had occasion to verify it. The iron composing this pipe becomes honeycombed by rusting.

I also called the attention of one of the medical members of the Board of Health to the condition of the gas pipe which passes through the arch of the sewer (at least $4\frac{1}{2}$ feet from its floor) in Calhoun Street, and demonstrated to him, by actual measurement by Mr. O'Rouke, that the pipe had been eaten away by rust and the effect of the sewer gas to the extent of half an inch. This destruction was so great as to cause leakage and render necessary the substitution of a new pipe. The loss of substance of the pipe was from the outer, not the inner, surface.

In this connection I call attention to an article in the Scientific American, 24th January, 1880, on the effect of sewer gas on metal. I sent this paper to the Committee while they were considering this subject, but no notice of this aspect of the question was taken. The paper quotes from "English paper," that lead and zinc are eaten through by sewer gas, and states that "the Sanitary Board of this city (New York) long since made the same discovery as to the corroding effect of sewer gas as reported above." After giving an instance of the destruction of a lead waste pipe,

it is said: "On taking down the waste pipe, we found it in many places honeycombed, and in others it had been so thinned as to be compressible between the thumb and finger." "This was probably due to the presence of carbonic acid gas in the sewage—a gas which is almost always present in drain pipes. Carbonic acid gas corrodes lead very rapidly; hence, the use of lead as a material for main drain pipes of dwellings has been generally abandoned, and iron pipes substituted. But even iron is not wholly free from objection, though it is considered safer than lead."

I have already mentioned that, in laying the water pipes in Charleston, the escape of gas through corroded and rusted gas pipes has been observed.

As to the engineering of the water pipes, I will grant that the first indication mentioned by the Committee has been fulfilled, viz: that the pipes have been placed at such a level as to enable them to resist atmospheric vicissitudes, and injury from traffic. I am not prepared to admit the second, viz: that the observance of a strictly level course has been maintained. It seems to be generally admitted that the pipes must have a strictly level course; indeed, the Committee say so, and Dr. Minor, of Cincinnati, says unless this be done, the pipes will break in the centre. Dr. Minor lays much stress on this, and insists that, in order to insure it in a soil of loose nature, there should be a bed of cracked rock on which to place the pipe.

In our works, this level has not been maintained, according to the report of the City Civil Engineer, in which, to escape one dilemma, he gets into another. He distinctly states he deflected his pipes to avoid passage through drains. I can point out, certainly, one place where this has been done, at the corner of Hasel and King streets, to avoid completely obstructing a sewer (only *one foot and a half*, by actual measurement, has been taken from the channel of the drain). I take his word that the like has been done in many other places. By this deflection, besides subjecting the pipes to the danger pointed out by Dr. Minor, two pipes meet at the joint at a very considerable angle, which

must render the joint very different from the specimen furnished to the Committee, disturbing materially the security of the hub and spigot joint.

In my opinion, much of the difficulty encountered in laying the water pipes has arisen from their location at the side of the road-way, and not near the centre of the street. Had the latter plan been adopted, the number of the yard and lateral drains injured would have been very much smaller. I am correct in this, if the pipes, as claimed in the Engineer's report, have only passed through the arches of the drains which they have perforated. Had the water pipes been laid near the centre of the street, the half foot or foot of fall of the lateral and yard drains (allowing their irregularity of level claimed) would have given just space enough to avoid their arches. In considering the laying of water pipes in Charleston, before applying the first pick to the ground, a careful survey should have been made, and the difficulties faced before the work was commenced. In other words, the system of drainage and drains should not have been disturbed until adequate preparation had been made to meet the exigencies of the case. As the matter now stands, the question, in the language of Dr. T. J. Turner, Secretary National Board of Health, giving his individual opinion, resolves itself "into this: either to give up the water supply or the drainage." The answer, to me, is plain—save the drains; but it has been answered differently—by permitting the work to go on uninterruptedly.

The next point necessary for me to notice is the unreasonable effort to establish, as a precedent, the passage of water pipes through the sewers of Paris, to sanction the placing of our water pipes within our drains and sewers. Compare with our drains and sewers the subterranean highways of Paris, probably built not only for drainage and sewerage, but as a means for the secret conduct of battalions, thoroughly ventilated, to make them suitable for such purpose. Who would think of inviting a highly honored guest of the City of Charleston to traverse its sewers? Yet, in Paris, it is not uncommon for a favored person to enter

and traverse the sewers, as one of the interesting establishments of that great City.

Suppose the water pipes passed through their whole length, subject to daily, even hourly, inspection. Under such circumstances the outer surface of the water mains can be kept constantly coated with preservative material to resist sewer gas, if such lingered in the spacious halls in spite of the ventilation. Threatened leaks could be discovered and remedied before becoming complete. Contrast this with the Charleston water pipes; these latter are hidden from view three and a half feet below the surface, and, where they traverse the drains and sewers, are bricked and mortared into them, and out of sight.

This view of the Paris water pipes, it appears to me, renders it irrational in the extreme to cite them as a precedent for the work done here. As this point in the report is calculated to take the public mind, and to mislead the people, I would refer to Appleton's American Cyclopædia, in which a pretty full account of these sewers, and those of London and other places, is given; and then contrast the condition of things in Charleston as far as the connection of the water pipes with the sewers is concerned.

I quote as to the Paris sewers, p. 795, Vol. XIV: "In many of the galleries are railways, on which cars are run in cleansing the sewers, and, also, for carrying visitors. The water and gas mains are also carried in the galleries covering the principal sewers."

In a letter to me, dated March 2, 1880, Dr. Folsom, Secretary Massachusetts Board of Health, says: "In Paris, the water pipes are never laid in or across the sewers." He gives drawings, showing the relations of the water pipes to the sewers, which speak for themselves.

The next point for comment is the statement that there is no system in the Charleston drainage.

I have only to refer to the elaborate and very able reports of the Committee of the City Council of Charleston on "Drainage and Health," during the Miles administration, who devised and carried out the tidal drains. Space forbids

my reviewing these reports. It is sufficient to say they indicate system in every line. In reply to the question, "Do you believe that the system of tidal drains and lateral and yard drains in existence in Charleston deserve the term system?" Dr. Wm. T. Wragg, who was Chairman of the Committee on "Drainage and Health," writes: "I say yes, it does, for it was devised after a most careful and protracted study of all the authorities available at the time, both European and American, as you will see by reference to the elaborate and numerous reports made to Council, from time to time, by the Committee on Health and Drainage, of the Miles administration." "The drains having been constructed, then, on the plan recommended by the Committee, and the adaptation of the drains to the purpose of running off storm water and yard drainage having been demonstrated to the satisfaction of the Council and of such of the citizens as chose to avail themselves of an invitation to witness the display, were put in operation under the care of a tidal drain keeper." That these drains have performed their functions is proved by observation.

Compare Broad and other streets in which there are drains with New Street, Savage Street, and others not so provided, and the correctness of the statement is evident. I clip the following from The News and Courier of February 10, 1880: "*A Bad Street.*—A large pool of water has accumulated in New Street, caused by obstruction in the drain, and vehicles are being driven over the pavement to avoid the pond of unknown depth. Several persons were fined by the Recorder, yesterday, for so driving, in violation of City Ordinance."

In Broad and other streets, in which the so-called incongruous piece of work in the shape of drains exists, no such accumulations have occurred, except recently in front of the Main Station House, where a collector remained many days, in consequence of the escape of the water being prevented by the excavation of the Water Works Company.

The next point for examination is the statement that "these are drains in our city—not sewers—for soil moisture,

not animal or human excreta; receptacles of surfacial deposit; and from deeper layers of salt water, itself an antiseptic." This statement is so very remarkable, that it scarcely needs comment. Space forbids my making quotations; but reference to Appleton, to a pamphlet on the "Privy System of New Orleans," to Martin, to Olgilvie, and any unabridged Dictionary, will show that the Committee's definition of sewers, sewerage, and drains, is not sustained.

It is admitted that our drains carry off the subsoil water, or, as it is expressed in the report, layers of salt water, itself an antiseptic. Before considering the properties and qualities of the subsoil water, in relation to sewage, I must correct a grave error on the part of the Committee—that salt water is subsoil in Charleston. Subsoil water is that which lies beneath the surface; were this salt water, how do our wells yield fresh? True, the water of most of the City wells is polluted by the percolation of privy vaults; a contamination increased by an unwise law, which encourages dry wells, and punishes sewer connections.

Dr. Wm. Hume, well remembered as Chemist, Physicist, and Sanitarian, in his celebrated letter to H. L. Pinckney, Mayor, December 18, 1838, on intra-mural interments, alludes to the error of attributing the saltiness of our City wells to the adjacent rivers, because of the impossibility of such a passage. He attributed it to the presence of the numerous salts which exist in animal remains and excretions.

With this disclosure of the incorrect data disappears the theory formed therefrom of the antiseptic influence of salt water in this connection.

That our drains draw the subsoil water is very easily demonstrated. Dr. Hume, in the paper above mentioned, calls particular attention to this action in our soil as applied to graveyards and privy vaults, by neighboring wells. In answer to this question as applied to our tidal drains, Dr. Wragg says: "Most certainly they do; and in order to allow of their doing so to the best advantage, the bottoms were lined with plank, leaving openings between them, and

the first two or three courses of brick in the cheek walls were laid without mortar." "But in order to understand how any action of this kind is affected, the nature of the soil through which they pass, must be considered. Briefly, then, let me remind you that the whole site of Charleston is underlaid by a lively quicksand, through which the water flows readily in all directions, following the influence of gravitation or pressure, so that when an excavation is made down to the level of its stratum, the water for a distance around flows into the opening. This is illustrated in every well dug into the soil. The distance to which this effect takes place, is in proportion to the quantity of water required to fill the excavation. If it be a well, then the drainage goes on till the well is full up to the level of the soil. But if it be a drain, the flow is continuous and the drainage reaches as far beyond the immediate vicinity of the drain, as the capacity of the drain to discharge the water admits of." "This was so evident during the construction of the tidal drains, that one of the chief difficulties the Committee encountered, was overcoming the objections made by the citizens to the drying of their wells. It became necessary for them to deepen them to a level below the bottom of the drains." "The soil of the Cemetery of St. Paul's Church, before the construction of the Coming Street drain, was so full of water, that it was constantly necessary to weight down the coffins in graves, while the earth was being filled in. Now there is a perfectly dry soil, down to the very bottom of the grave."

Dr. Wragg also mentions, that Mr. Ruffin, passing through Charleston, was so attracted by the work of the tidal drains, that he expressed his admiration of it; and wrote a letter saying that the drainage affected in the soil, would be equivalent to elevating the whole site of Charleston, six or eight feet above its then level, thus materially increasing the salubrity of its climate. That this improvement in the health of Charleston, by these drains, did take place, is proved by an examination of her sanitary record; and it will be seen, that whilst, before their construction, we were visit-

ed almost yearly by yellow fever, since then we have enjoyed comparative immunity.

Dr. Wragg says, the Committee on drains and health had abundant correspondence with the eminent engineers, at that time engaged in the construction of similar works in other cities, especially with Mr. Chesborough, author of the splendid system of works in Chicago.

It having thus been proved, that our drains and sewers have a most important influence on the subsoil water, we come now to the consideration of the subsoil water itself.

The system of privy vaults and dry wells it is well known prevails in Charleston, indeed it is so stated by the Committee of the Board of Health; and with an air of triumph it is stated by them, that the Board is about to realize a great improvement by the annual removal of their contents by the odorless excavator. It is known that the contents of these vaults and dry wells, consisting of human excreta, loaded with the specific germs of disease, which they may contain, percolate into the soil, indeed are dissolved and carried away with the rise and fall of the subsoil water. Therefore we have the soluble portions of the animal excreta therein collected, transferred to the soil and subsoil water, thence into sewers, converting them into sewers not only according to my opinion but in accordance with the views of the Committee.

Dr. Hume has alluded to this transfer of the contents of vaults and privies to the wells, in the letter of 18th December, 1838, above referred to. The importance of this matter is so great that I must extract from the pamphlet entitled: "The Evil and Remedy for the Privy system of New Orleans." In New Orleans the same system of privy vaults exists, and the circumstances are very much the same as in Charleston, only more favorable as to elevation, perhaps.

"Fixing the amount of excreta, solid and fluid, at 3 lbs. daily, (the average per capita of entire population,) we find that upon and into these 4860 acres crowded with human beings, is poured 570,000 lbs. of their excreta every 24 hours, or 17,100,000 lbs. in one month of 30 days, or 208,050,000

in one year." "Placing the amount of matter removed by the vidangeurs at the maximum average of 15,000 gallons daily, (a high estimate,) each gallon weighing $10\frac{1}{2}$ lbs., we find the daily removal of 157,500 lbs.; in one month of 26 working days, 4,095,000 lbs. or 49,297,500 annually, leaving in this crowded City, to be disposed of by nature as best she can, the enormous amount of 150,752,500 lbs., the deposit of a single year."

Taking this calculation as a standard, and for convenience estimating the population of Charleston at 60,000, we find that in one day there is collected 180,000 lbs.; in one month 4,600,000 lbs., and in one year 55,200,000 lbs. According to the Committee this is to be left in the vaults and dry wells for one year. This is the amount of human excreta alone which has to be removed, and from what has been said the soluble portions are carried into our soil, and thence by the subsoil water into our drains and sewers. Does it not seem then that we may class our drains and sewers as sewers according to the arbitrary standard established by the Committee? The Committee dwells "pertinently on the fact that no drains are filled with human excreta." If what has been already said is not sufficient to disprove this statement, let us allude to a fact well known, viz: that many water closet connections have been made with the drains. If this be doubted, the workmen of the Water Works as well as the Sanitary Inspector of the work, can testify that in breaking into the drains to place the water pipes they frequently found such connections. This can be proved, and we need go no further than the record of the Board of Health for the evidence. In The News and Courier, February 26, 1880, I find that after passing resolutions highly eulogistic of the Report of the Committee on Hygiene, the Board had read to them a "Communication from a citizen requesting the attention of the Board of Health to the connection existing between some of the vaults in this City with the common sewers of the City, was referred to the Committee on Low Lots and Nuisances." I will allude in this connection to the statement of the Com-

mittee "that no pipe rests in sewage matter in Charleston since these drains contain the foul soil moisture and domestic matters of kitchen and yard, upon much of which, did time and space permit, we could show the effect of earth through which percolation has taken place." I must here also call attention to an inconsistency in the report where it is hinted that our cisterns are poisoned by means of this same process of percolation through the earth. It is known moreover that earth, when saturated with organic matter and moisture, loses its power of filtration and its property as a deodorizer and disinfectant. Just here I must defend and sustain a statement made by me that the water mains pass through the sewer which receives the drainage of the hospitals of the City. I know every part of the Roper Hospital and its appointments, because I lived there for the first two years of my professional life. I know that the human excreta from that building are received into two dry wells close to the North wall of the Hospital, (a very bad arrangement in a sanitary point of view,) and that these wells have no direct communication with the yard drains.

I assert again, however, that by the process of percolation from these vaults and passage to the sewers of the sub-soil water, the soluble parts of the excreta of the patients, whether they have typhoid fever or other disease, find their way into the Queen Street sewer. I have the written statement of a gentleman that he saw the water mains pass through this sewer near its floor, and that sewage poured out of either opening made for the passage emitting foul odors. I think this is sufficient warrant for my statement. In passing I must allude to the statement of the Committee that in two places—one in King Street and the other in George Street—the Water Company repaired the damage done to two drains, putting down iron pipes in their stead. These two instances prove the justice of the points raised, and indicate a virtual admission on the part of the Company of the damage done. It must be remembered that this was during the progress of this discussion, and it is certain, from

the evidence presented, that the same damage has been accomplished along the whole course of the pipe laying without similar repair. Had the Committee conducted the investigation so desired and requested by me, this would have been discovered.

As to the pipe laying in Rutledge Street, permit me to say that, unless the circumstances connected with it had been seen by the Committee, they could form no adequate opinion in relation to it or appreciate the evil. Much of this portion of the town is made land, composed of decomposing matters, and the pipes were laid in a filthy fluid, that gave off a stench so offensive as to cause great complaint, not only from those passing, but the workmen themselves spoke of it.

The Committee were charged with the duty of making investigations as to the possibility of contamination of the water, by sewer gas and sewage. They have offered nothing but theories as a basis for their "determinate report."

No mention is made of original investigation, and certainly no details are given of experiments, either made by themselves or recorded by others, bearing on the possibility of the contamination of the water, under the circumstances that exist. They have not proved the impermeability of these cast iron pipes. They have not tested their inside strength, nor in the case of these particular pipes can they assure us of their durability.

They cannot assure us that the flow of water will be continuous, and have not attempted to controvert the grounds on which I have shown that it is subject to intermission. They have given no experiments to prove that osmosis cannot take place, or gaseous penetration cannot occur with the rush of water outwards, in the event of cleavage or perforation of the pipes. Their words are "no gaseous penetration appears possible." It seems to me, that these expressions are not a sufficient basis for a "determinate" statement.

In support of my views I can offer you theories, and do give you facts. I have quoted an authenticated case, in

which water passing through a pipe became contaminated by sewer poison, and produced an epidemic of disease. The connection between the disease and the water supply was absolutely proved. The nature of the substance of which the water pipe in this instance was composed is not material in this connection, for the question here is the possibility of contamination of the water by gas or sewage against pressure.

In the case quoted, the water supply was conducted from a river five miles distant from the town supplied. It must be evident to the unprejudiced mind that a certain amount of pressure or (its equivalent in this connection) velocity must have been present to cause the water to deliver itself after traveling such a distance. If this were not enough, I add the following letter in answer to questions of the Committee on Hygiene:

COMMONWEALTH OF MASSACHUSETTS,
State Board of Health, Lunacy and Charity,
State House, Boston, Mass., March 2, 1880.

Dr. J. S. Buist:

DEAR DOCTOR—I owe you an apology for my tardy reply to your note. Our City Engineer does not know of any cases where water pipes enter or pass through sewers, and strongly condemns the practice. With some trouble I have found that formerly the thing was done, but very seldom, as trouble came from it very soon. Now we go over the sewers or under, by a special inverted siphon cast for that purpose. Theoretically, iron pipes can be made perfectly tight; but we find here that even when under pressure they have, in certain cases, allowed leakage into them.

Begging a thousand pardons for my allowing your letter to get concealed under the enormous pile on my table,

I am, very sincerely and respectfully,

CHAS. F. FOLSON.

I send a copy to Dr. Simons.

The next point to be considered is the Committee's "clincher," which, if I may be pardoned for an expression of opinion, seems to me to be the most far-fetched I ever

heard. The Committee begin by admitting, for argument sake, that the pipes are "laid actually in sewage, or in close proximity with nitrogenous substances, undergoing retrogressive metamorphoses, resolving themselves into elementary compounds." They then state that "iron water pipes have a distinct chemical value, because by the action on iron of nitrogenous organic matter produces nitrous acid—nature's scavenger." No experiments have been made by the Committee to verify this statement, or they have not stated them in detail. They certainly have given no details of the chemical process that takes place under such circumstances. Are we to suppose that the action of the iron is brought about only by its presence (catalysis), or that itself undergoes chemical change at the same time? This is important. It can hardly be supposed that the action of the iron under these circumstances is catalytic. If it is not due only to the presence of the iron, then it must be brought about by chemical change which the iron itself undergoes. If the latter supposition explains the meaning of the Committee, then I must use one of their own arguments in refuting their theory, that the iron will produce "nature's scavenger." They have stated in their argument for the longevity of the water pipes, that they have, because of their mode of preparation, powers of resisting chemical action in the form of oxydation, which we have seen is not possessed by the cast iron of the gas pipes. They have not given us the formula representing the chemical changes, so that I can only meet their statements generally.

Let us look at this "clincher" in two other aspects. Is this scavenger and antiseptic action of the iron water pipes to be exercised on the sewage in which they lie, or upon the contaminated water which the pipes themselves, for argument sake, may be supposed to contain?

In regard to the first view, I may mention that it is stated, on excellent authority, that our best antiseptics and "disinfectants"—"carbolic acid, copperas (sulphate of iron), and other similar agents—can only disinfect thoroughly when *in* ~~ultimately~~ commingled with the sewage mass. The quan-

tity required, as determined by experiment, is a mean of $\frac{3}{4}$ lb. copperas or 1 oz. of carbolic acid to every cubic foot of sewage." What would be the effect on the water pipe of a chemical action sufficient to produce nitrous acid (nature's scavenger) to equal in disinfecting value the quantity of copperas and carbolic acid mentioned?

Now let us take the other view. Is this antiseptic and disinfectant action of nitrous acid expected by the Committee to act upon the water contained in the pipes? In quoting Muspratt's observations, the Committee say that the distinguished chemist "declares that when water has remained in *long* contact with a *large* surface of iron every trace of organic matter was in two days rendered insoluble or wholly destroyed." Can it be reasonable to apply these observations to our Artesian water if it were contaminated with organic matter, delivered, as it is said that it will be, "by pressure, in a constant flow and with fixed velocity"? It must be remembered that the Water Works are to supply street hydrants, public buildings and charities, private residences and factories; it is therefore to be subject to constant draught. Under these circumstances, I ask, how long will any given quantity of water remain in contact with these iron pipes, generators of "nature's scavenger"? How often in the specified time of two days will the water in these water mains be changed? How infinitesimally small must be the quantity of nitrous acid to each gallon of water? I expect that it would be found to amount to none at all.

Upon the experiments of Medlock I will make no comment, for they are so loosely quoted, without details as to the circumstances attending them, that I can make nothing out of them as applied in this connection by the Committee.

It may be said in reply, that in the exercise of this antiseptic power by the water mains, though they participate in the chemical changes which result in the formation of nitrous acid, a solid and stable compound like the sulphide of iron may be formed. In answer to this, I will reply that the Committee have not alluded to the formation of any

such compound, which would add to, or at least preserve, the weight and volume of the pipe.

Even had they done so, I think the question would be pertinent—whether the tensile strength of the pipes would not thus be destroyed or injured, causing unequal resistance or unusual porosity? I would suggest that the Committee have virtually admitted the possibility of contamination, though they state that no apprehension of it need be entertained, when they recommend semi-annual analysis of the water. They say that this is customary in other cities which possess water works; but it appears to me that, with the views they entertained, it is highly illogical to recommend such examinations.

As they have, in their own opinion, "determinatively" established the impossibility of the water being contaminated in its passage through the drains, enclosed in cast iron pipes, then they must expect the Artesian wells, from which our water supply is to be derived, to yield contaminated water from the bowels of the earth periodically, fixed by the Committee at semi-annual intervals.

Granting that the water of our Artesian wells may have a trace more albuminoid matter to-day than when first bored, we have already had long experience of its healthfulness.

I could understand the propriety of recommending such examinations of our water, if it were to be derived from rivers liable to pollution by drainage, and the washings from sugar refineries, tan-yards, and soap factories.

But, as the Committee deny that the experience of man has taught the length of life of a water pipe, and that it is permeable to deleterious matters, either gaseous or material, at the same time that they regard the joints perfect, it is illogical for them to recommend semi-annual examinations.

In conclusion, gentlemen, permit me to express my satisfaction that I differ from the writer of the report of the Committee on Hygiene on all matters pertaining to sanitary medicine.

He has recorded his belief that filth and decomposing animal and vegetable matters are not injurious to health.

I find, on examination of my medical scrap-book, an elaborate paper from the pen of this gentleman, read before the Board of Health, of which he was a member, in June, 1877, in which his views on these matters may be found, and I refer those who desire to know them to The News and Courier, June 7, 1877, in which the proceedings of the meeting were published.

This paper produced a great stir among the medical men of the City, as the views expressed are diametrically opposed to sanitary laws, and are subversive of the very foundation upon which sanitary medicine and public health rests.

I would also mention that Dr. Lebby, then City Registrar, and a member of the Committee from which that report came, refused to sign it. See News and Courier, June 7, 1877. On the same page in my scrap-book, I find an excellent paper from Dr. F. Peyre Porcher, opposing the views set forth in the report.

The occasion of the report was complaint against filling low places within the City limits with the scavenger accumulations. Of the opinions on sanitary medicine of the other members of the Committee I know nothing, except as contained in the recent report.

"We shall not describe the particular effects of tainted food, whether solid or fluid, on the body, how impure water may be drank," or, says the report, "what becomes of the epicure who never eats his game until it crawls off the table."

It does seem to me that a policy based on the idea that the drains of the City contain nothing that can be deleterious to health; that their stoppage is of no moment; that the filling up of low places in the City with scavenger matter is not dangerous; that the eating of spoiled meat is harmless, to which may be added the possible contamination of the water supply, will scarcely recommend itself to favorable consideration generally.

I will now say to you gentlemen, that with this communication my connection with the question of the Water Works ceases. My object has been to benefit the City, and my work has been in the interests of the people and public

health. The responsibility of seeing that the interests of the community are protected is with you, not me.

I am, with high respect,

MANNING SIMONS, M. D.

March 5^d, 1880